

We claim:

- 5 1. A process for preparing transformed plant cells or organisms, which comprises the following steps:
  - a) transforming a population of plant cells, with the cells of said population containing at least one marker protein, capable of causing directly or indirectly a toxic effect for said population, with at least one nucleic acid sequence to be inserted in combination with at least one double-stranded marker protein ribonucleic acid sequence or an expression cassette or expression cassettes ensuring expression thereof capable of reducing the expression of at least one marker protein, and
  - b) selecting transformed plant cells whose genome contains said nucleic acid sequence and which have a growth advantage over nontransformed cells, due to the action of said double-stranded marker protein ribonucleic acid sequence, from said population of plant cells, the selection being carried out under conditions under which the marker protein can exert its toxic effect on the nontransformed cells.
- 10 2. The process as claimed in claim 1, wherein the marker protein is capable of converting directly or indirectly a substance X which is nontoxic for said population of plant cells into a substance Y which is toxic for said population, which process comprises the following steps:
  - a) transforming the population of plant cells with at least one nucleic acid sequence to be inserted in combination with at least one double-stranded marker protein ribonucleic acid sequence or an expression cassette or expression cassettes ensuring expression thereof capable of reducing the expression of at least one marker protein, and
  - 15 b) treating said population of plant cells with the substance X at a concentration which causes a toxic effect for nontransformed cells, due to the conversion by the marker protein, and
  - 20 c) selecting transformed plant cells whose genome contains said nucleic acid sequence and which have a growth advantage over nontransformed cells, due to the action of said
- 25 3. The process as claimed in claim 1, wherein the marker protein is capable of converting directly or indirectly a substance X which is nontoxic for said population of plant cells into a substance Y which is toxic for said population, which process comprises the following steps:
  - a) transforming the population of plant cells with at least one nucleic acid sequence to be inserted in combination with at least one double-stranded marker protein ribonucleic acid sequence or an expression cassette or expression cassettes ensuring expression thereof capable of reducing the expression of at least one marker protein, and
  - 30 b) selecting transformed plant cells whose genome contains said nucleic acid sequence and which have a growth advantage over nontransformed cells, due to the action of said
- 35 4. The process as claimed in claim 1, wherein the marker protein is capable of converting directly or indirectly a substance X which is nontoxic for said population of plant cells into a substance Y which is toxic for said population, which process comprises the following steps:
  - a) transforming the population of plant cells with at least one nucleic acid sequence to be inserted in combination with at least one double-stranded marker protein ribonucleic acid sequence or an expression cassette or expression cassettes ensuring expression thereof capable of reducing the expression of at least one marker protein, and
  - 40 b) selecting transformed plant cells whose genome contains said nucleic acid sequence and which have a growth advantage over nontransformed cells, due to the action of said
- 45 5. The process as claimed in claim 1, wherein the marker protein is capable of converting directly or indirectly a substance X which is nontoxic for said population of plant cells into a substance Y which is toxic for said population, which process comprises the following steps:
  - a) transforming the population of plant cells with at least one nucleic acid sequence to be inserted in combination with at least one double-stranded marker protein ribonucleic acid sequence or an expression cassette or expression cassettes ensuring expression thereof capable of reducing the expression of at least one marker protein, and
  - b) selecting transformed plant cells whose genome contains said nucleic acid sequence and which have a growth advantage over nontransformed cells, due to the action of said

double-stranded marker protein ribonucleic acid sequence, from said population of plant cells, the selection being carried out under conditions under which the marker protein can exert its toxic effect on the nontransformed 5 cells.

3. The process as claimed in claim 2, wherein the nontoxic substance X is a substance which does not naturally occur in 10 plant cells or organisms or occurs naturally therein only at a concentration which can essentially not cause any toxic effect.
4. The process as claimed in claim 2 or 3, wherein the substance 15 X is a substance selected from the group consisting of pro-herbicides, proantibiotics, nucleoside analogs, 5-fluorocytosine, auxinamide compounds, naphthalacetamide, dihaloalkanes, Acyclovir, Ganciclovir, 1,2-deoxy-2-fluoro-*b*-D-arabinofurano-sil-5-iodouracil, 6-thioxanthine, allopurinol, 6-methylpurine 20 deoxyribonucleoside, 4-aminopyrazolopyrimidine, 2-amino-4-methoxybutanoic acid, 5-(trifluoromethyl)thioribose and allyl alcohol.
5. The process as claimed in any of claims 1 to 4, wherein the 25 marker protein is selected from the group consisting of cytosine deaminases, cytochrome P-450 enzymes, indoleacetic acid hydrolases, haloalkane dehalogenases, thymidine kinases, guanine phosphoribosyl transferases, hypoxanthine phosphoribosyl transferases, xanthine guanine phosphoribosyl transferases, purine nucleoside phosphorylases, phosphonate monoester hydrolases, indoleacetamide synthases, indoleacetamide hydro-lases, adenine phosphoribosyl transferases, methoxinine dehydrogenases, rhizobitoxin synthases, 5-methylthioribose 30 kinases and alcohol dehydrogenases.
6. The process as claimed in any of claims 1 to 5, wherein the 35 marker protein is encoded by
  - a) a sequence described by the GenBank accession number S56903, M32238, NC003308, AE009419, AB016260, NC002147, M26950, J02224, V00470, V00467, U10247, M13422, X00221, M60917, U44852, M61151, AF039169, AB025110, AF212863, AC079674, X77943, M12196, AF172282, X04049 or AF253472
  - b) a sequence according to SEQ ID NO: 2, 4, 6, 8, 10, 12, 45 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40,

42, 44, 46 or 48.

7. The process as claimed in any of claims 1 to 6, wherein a sequence coding for a resistance to at least one toxin, antibiotic or herbicide is introduced together with the nucleic acid sequence to be inserted and selection is carried out additionally using the toxin, antibiotic or herbicide.

10 8. The process as claimed in any of claims 1 to 7, wherein the nucleic acid sequence to be inserted into the genome of the plant cell or of the plant organism comprises at least one expression cassette capable of expressing, under the control of a promoter functional in plant cells or in plant organisms, an RNA and/or a protein which does not cause the expression, amount, activity and/or function of a marker protein to be reduced.

15 9. The process as claimed in any of claims 1 to 8, wherein the plant cell is part of a plant organism or of a tissue, part, organ, cell culture or propagation material derived therefrom.

20 25 10. The process as claimed in any of claims 1 to 9 for preparing transformed plant cells or organisms, which comprises the following steps:

30 a) transforming a population of plant cells which comprises at least one non-endogenous (preferably non-plant) marker protein capable of converting directly or indirectly a substance X which is nontoxic for said population of plant cells into a substance Y which is toxic for said population, with at least one nucleic acid sequence to be inserted in combination with at least one nucleic acid sequence coding for a double-stranded marker protein ribonucleic acid sequence or an expression cassette or expression cassettes ensuring expression thereof ribonucleic acid sequence capable of reducing the expression, amount, activity and/or function of said marker protein, and

35 40 45 b) treating said population of plant cells with the substance X at a concentration which causes a toxic effect for nontransformed cells, due to the conversion by the marker protein, and

5           c) selecting transformed plant cells (and/or populations of plant cells, such as plant tissues or plants) whose genome contains said nucleic acid sequence and which have a growth advantage over nontransformed cells, due to the action of said double-stranded marker protein ribonucleic acid sequence, from said population of plant cells, the selection being carried out under conditions under which the marker protein can exert its toxic effect on the non-transformed cells, and

10           d) regenerating fertile plants, and

15           e) eliminating by crossing the nucleic acid sequence coding for the marker protein and isolating fertile plants whose genome contains said nucleic acid sequence but does not contain any longer the sequence coding for the marker protein.

20 11. An amino acid sequence coding for a plant 5-methylthioribose kinase, wherein said amino acid sequence contains at least one sequence selected from the group consisting of SEQ ID NO: 60, 62, 64, 66 or 68.

25 12. A nucleic acid sequence coding for a plant 5-methylthioribose kinase, wherein said nucleic acid sequence contains at least one sequence selected from the group consisting of SEQ ID NO: 59, 61, 63, 65 or 67.

30 13. A double-stranded RNA molecule, comprising

35           a) a "sense" RNA strand comprising at least one ribonucleotide sequence which is essentially identical to at least a part of the "sense" RNA transcript of a nucleic acid sequence coding for a marker protein, and

40           b) an "antisense" RNA strand which is essentially, preferably fully, complementary to the RNA sense strand under a).

45 14. The double-stranded RNA molecule as claimed in claim 13, wherein the marker protein is defined as in any of claims 2 to 6.

15. The double-stranded RNA molecule as claimed in either of claims 13 and 14, wherein the "sense" RNA strand and the "an-

tisense" RNA strand are covalently linked to one another in the form of an inverted repeat.

16. A transgenic expression cassette, comprising a nucleic acid sequence which codes for a double-stranded RNA molecule as claimed in any of claims 13 to 15 and which is functionally linked to a promoter functional in plant organisms.

10 17. A transgenic vector, comprising a transgenic expression cassette as claimed in claim 16.

15 18. A transgenic plant organism, comprising a double-stranded RNA molecule as claimed in any of claims 13 to 15, a transgenic expression cassette as claimed in claim 16 or a transgenic vector as claimed in claim 17.

19. The transgenic plant organism as claimed in claim 18, selected from the group of plants, consisting of wheat, oats, millet, barley, rye, corn, rice, buckwheat, sorghum, triticale, spelt, linseed, sugar cane, oilseed rape, cress, arabisopsis, cabbage species, soybean, alfalfa, pea, bean plants, peanut, potato, tobacco, tomato, eggplant, paprika, sunflower, tagetes, lettuce, calendula, melon, pumpkin and zucchini.

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20 20. A tissue, an organ, a part, a cell, a cell culture or propagation material, derived from a transgenic plant organism as claimed in either of claims 18 and 19.

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